CLAIMS

1. A method for manufacturing a single electron device, comprising electro-migrating passivated metal nanoclusters by forcing the nanoclusters to assemble over a patterned substrate under control of a non-homogeneous electric field.

2. The method according to claim 1 wherein the electro-migrating step and a desired location of the metallic passivated nanoclusters are based on a dielectrophoretic process.

3. The method according to claim 1 including:

synthesizing metallic nanoclusters surrounded by a dielectric shell of thioles of controlled size;

depositing the metallic nanoclusters by dielectrophoresis; and

sintering the nanoclusters in a nanowire after desorbation of the dielectric shell as result of heating.

4. The method according to claim 3 wherein said synthesizing step includes:

synthesizing active metal to produce a metallic suspension;

superficially passivating the metal with thiol; and

extracting and purifying the thiol-passivated metal.

5. The method according to claim 4 wherein said step of synthesizing the active metal includes:

<u>*1st stage*</u> *Crystallized metal compound → intermediate phase*

- progressively dissolving the crystallized metal compound;
- precipitating the intermediate phase; and
- evolving water by distilling the intermediate phase;

2nd stage *Intermediate phase → metal*

- dissolving the intermediate phase;
- reducing the intermediate phase in solution;
- evolving volatile products of reaction; and
- spontaneously nucleating and growing metal particles.

6. The method according to claim 4 wherein said step of superficially passivating a metal with thiol includes cooling the metallic suspension and treating it at room temperature with a dodecanthiol ($CH_3(CH_2)_{11}SH$) solution or with a thiol excess ($CH_3(CH_2)_nSH$).7. The method according to claim 4 wherein said extracting and purifying step includes separating said metallic nanoclusters by extraction with hydrocarbon (wet-way process) or by addition of water following filtration (dry-way process); then said metallic nanoclusters are purified for dissolution in ethyl alcohol and precipitation with acetone; the precipitation product is separated by centrifugation and made dry to air.

8. The method according to claim 1 wherein the electro-migrating steps includes forming on an electrode a nanocontact under control of the electric field, and thus using the nanocontact as a target that offers a reference point for growing a nanowire by moving the nanoclusters under the control of the electric field.

9. The method according to claim 8, further comprising:

processing a substrate by lithography to obtain a metallic layer between two oxide layers, with a free face of the metallic layer being available for electrodeposition; wherein forming the nanocontact includes:

applying the electric field between a flat panel and the metallic free face, to cause one of the passivated nanoclusters, having a size comparable to a thickness of the metallic layer and being passivated with a dielectric shell of thioles, to move to the free face, under dielectrophoresis; and

heating the substrate until a degradation temperature of the thiols is reached, thereby causing the dielectric shell, surrounding a metal core of the one of the passivated nanoclusters, vanishes leaving a nanoparticle that finds stability joining the free face.

10. The method according to claim 1 wherein the electro-migrating step is performed at room temperature.

11. A method of manufacturing a nanocluster device, comprising:

forming conductive nanoparticles; and

forming a nanocluster contact at a first electrode by forcing the nanoparticles to the first electrode under control of a non-homogeneous electric field produced by a second electrode.

12. The method of claim 11, further comprising:

passivating the nanoparticles with dielectric shells; and

heating the nanoparticles to remove the dielectric shells after the passivated nanoparticles are forced to the first electrode.

13. The method of claim 12 wherein the passivating step includes superficially passivating the metal nanoparticles with thiol and extracting and purifying the thiol-passivated nanoparticles.

14. The method of claim 13 wherein forming the nanoparticles includes:

progressively dissolving a crystallized metal compound

precipitating an intermediary phase;

evolving water by distilling the intermediate phase;

dissolving the intermediate phase;

reducing the intermediate phase in solution;

evolving volatile products of reaction; and

spontaneously nucleating and growing the metallic nanoparticles.

15. The method of claim 13 wherein the step of superficially passivating the metal with thiol includes cooling the metallic suspension and treating it at room temperature with a dodecanthiol ($CH_3(CH_2)_{11}SH$) solution or with a thiol excess ($CH_3(CH_2)_nSH$).16. The method of claim 1 wherein the electro-migrating steps includes forming on an electrode a nanocontact under control of the electric field, and thus using the nanocontact as a target that offers a reference point for growing a nanowire by moving the nanoclusters under the control of the electric field.

17. The method according to claim 11, further comprising:

forming a substrate that includes an upper, first dielectric layer;

forming the first electrode on the first dielectric layer;

forming a second dielectric layer on the first electrode and having an opening that exposes a free face of the first electrode; and

forming the second electrode facing the opening in the second dielectric layer.

18. A nanocluster production device, comprising:

a substrate that includes an upper, first dielectric layer;

a first electrode positioned on the first dielectric layer;

a second dielectric layer positioned on the first electrode and having an opening that exposes a free face of the first electrode;

a second electrode facing the opening in the second dielectric layer, the second electrode being driven to provide a non-homogeneous electric field in the opening; and

a conductive nanoparticle positioned in the opening, the nanoparticle being forced into contact with the free face of the first electrode by the non-homogeneous electric field.

19. The device of claim 18 wherein the nanoparticle is passivated with a dielectric shell, the device further comprising a heater positioned adjacent to the substrate and structured to heat the nanoparticle to remove the dielectric shell.

20. The device of claim 18 wherein the first and second dielectric layers are part of a single dielectric layer in which the first electrode is embedded.

21. The device of claim 18 wherein the second electrode is positioned on the second dielectric layer and has a free face that is perpendicular to the free face of the first electrode.

22. The device of claim 21, further comprising a third electrode positioned between the first and second dielectric layers and having a free face on an opposite side of the opening with respect to the free face of the first electrode.

23. The device of claim 18 wherein the nanoparticle is a metal.